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Multicriteria Decision Making

by Andrew Vazsonyi, McLaren School of Business, University of San Francisco

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Most of us believe that when teaching decision sciences we must emphasize the interaction between the model and the decision maker. However, we find it difficult to implement this fundamental principle, because we may lose the student in the mathematical intricacies of an optimizing model and miss the essence of the problem of making decisions. I believe that we can teach multicriteria decision making using very simple models, and focus on many aspects of the essence of decision sciences. Moreover, we can avoid all computational and graphic difficulties by using spreadsheets.

Let me illustrate the point by presenting a practical case study used by Kepner and Tregoe: the problem of selecting a software vendor. I'll use the example as a *coat hanger*, on which to "hang" some basic concepts of management science.

The Vendor Selection Problem

The student must understand that management needs to be helped and stimulated to agree on a set of **attributes** to be used in the selection process. Suppose that decision conferencing leads to the list:

- Quality of software
- Hardware performance
- User support
- Cost for five years
- Vendor reputation
- Application programs
- Delivery reliability
- Growth potential

The next step is ranking the attributes in decreasing importance and assigning weights of importance. Each vendor is scored on each attribute, using a scale of 0 to 10. Then the utility of each vendor is calculated by using a linear utility function of the form

$$(w_1 \cdot x_1) + (w_2 \cdot x_2) + (w_3 \cdot x_3) + \dots + (w_8 \cdot x_8),$$

where the x 's are the numeric values of the attributes, and the w 's, the weights, that is, the measures of the relative importance of the attributes. This is the only model used in the analysis. The central problem is to assess the eight parameters of the model. The student is not confused by mathematical complexities.

The Assessment Problem

The parameters must be assessed so that insight and consensus is reached by the decision makers. The task is accomplished by WHAT-IF dialogs where the impact of alternate values of the parameters is reviewed. The tool to accomplish the task is the numeric and graphic images presented by the computer screen. These include such information as

- The ranking of the vendors
- Horizontal bar charts with pair-wise comparisons (Exhibit 1)
- Tradeoff charts for comparison of vendors for any pair of attributes (Exhibit 2).

There are only a few alternatives, and there is no room for optimization techniques. Managers make pair-wise comparisons between alternatives that differ only on two attributes, using the concept

of *caeteris paribus*. Introducing intermediate phantom alternatives builds the chain to compare real alternatives. The concept of dominance filters out inferior solutions, and the concept of Pareto efficient solutions identifies the solution space. Samples of other concepts of decision sciences to "hang" on the tree are: indifference, perturbations, robust vs. fragile solutions.

More Complex Models

I deliberately ignored discussing hierarchical and nonlinear models, and the Analytical Hierarchy process, because I wanted to stay away from any complicating mathematical features. However, the spreadsheet approach of using tradeoffs and WHAT-IF analysis can be extended to more complex models, without requiring sophisticated mathematics. The references below provide source material to develop more advanced models.

Conclusions

We ought to teach multiattribute decision making in the early part of our curriculum to empower the instructor to discuss important concepts of management science without being burdened by complex mathematical models. Such concepts in-

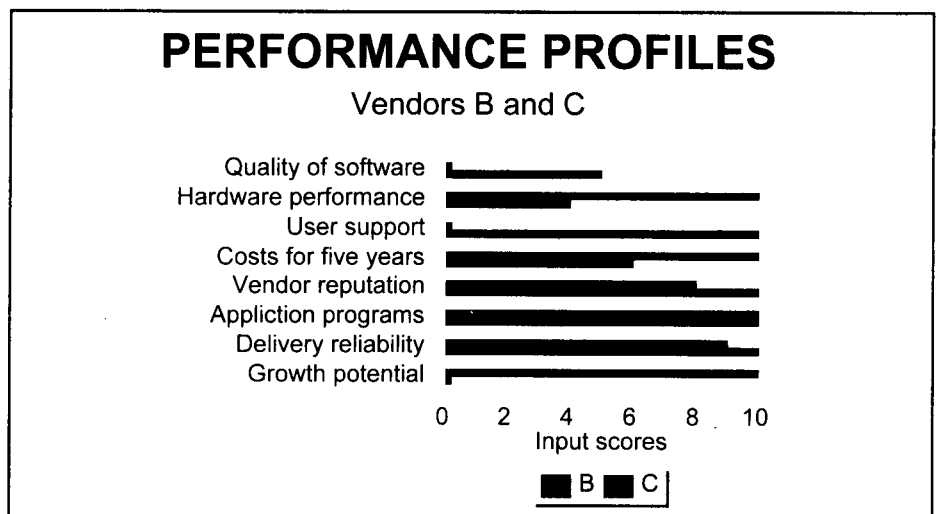


Exhibit 1: Performance profiles: Vendors B and C.

clude: satisficing versus optimization, normative versus descriptive models, decision support and facilitation, WHAT-IF and sensitivity analysis, tradeoff, utility, value and goal-oriented thinking, dominated and Pareto efficient solutions, robust versus fragile solutions, the principle of caeteris paribus, phantom alternatives, group decision making and decision conferencing.

Working with such quantitative models, carrying out calculations, and performing graphic analysis, including floating graphic representations, is made possible by spreadsheets systems.

References

- Keeney, R.L., *Value Focused Thinking: A Path to Creative Decision Making*, Harvard University Press, 1992.
- Keeney, R.L. and Raiffa, Howard, *Decisions with Multiple Objectives: Preferences and Value Tradeoffs*, John Wiley & Sons, 1976.
- Keptner, C.H. and Tregoe, B.B., *The New Rational Manager*, Princeton Press, Princeton, NJ, 1981.

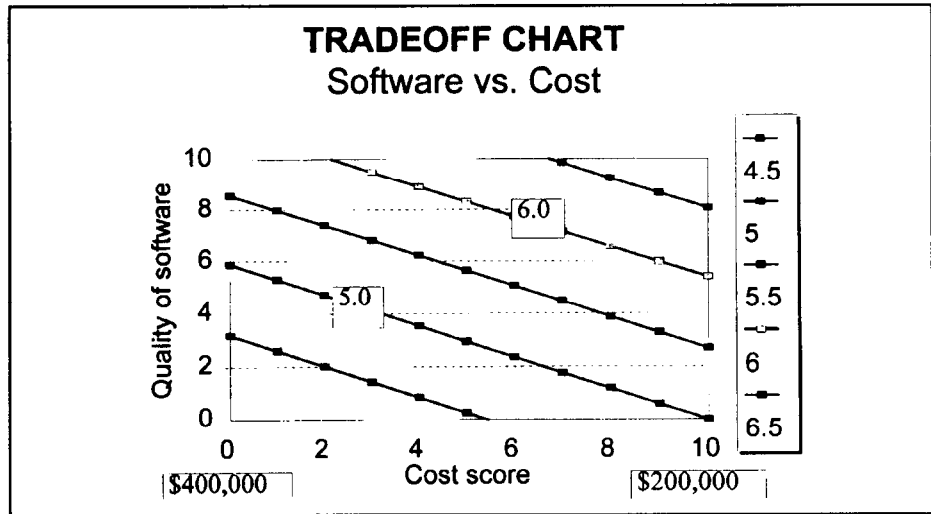


Exhibit 2: Trade-off chart: software vs. cost.

Saaty, T.L., *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World*, Wadsworth, 1982. ■

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REGIONS

Southeast Region

by Tim Burwell, Appalachian State University

The annual meeting of the Southeast Region of the Decision Sciences Institute will be held at the Wilmington Hilton in Wilmington, NC, on February 23-25, 1995. The hotel is located on the Cape Fear River in the heart of downtown. Room rates are \$65 for a single or a double. The conference will start at 1:30 p.m. on Thursday, February 23.

There will be two industry tours. The first is to Interroll, a leading world-wide manufacturer of material handling devices. The second is to a General Electric plant with a world-class flexible manufacturing system producing aircraft engine casings. Because security clearance is necessary, sign-up for the GE tour is no later than 5:00 p.m. on Thursday, February 23.

This will be the 25th anniversary of the SEDSI meeting. In order to celebrate our silver anniversary, Program Chair Stephanie Robbins will create a collage of 25-year-old photographs from this year's meeting participants. If you wish to send a photograph of yourself from 25 years ago or have questions, please contact:

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Call For Distinguished Service Award Nominations

The Southeast Decision Sciences Institute is accepting nominations for distinguished service to the Southeast Region of the Decision Sciences Institute. Nominations should include a cover letter supporting the candidate's nomination, plus documented service to the organization. Deadline for nominations is January 30, 1995. All nominations should be mailed to:

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